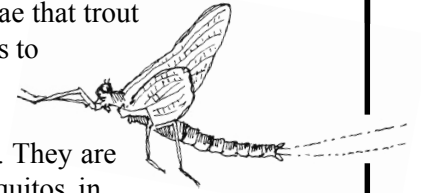


Objectives: Students will learn to recognize different aquatic insects and their larvae that trout feed upon, learn about trout feeding behavior, and become aware of potential threats to trout and the insects upon which they feed. Science Core: Standard V, Objective 4.

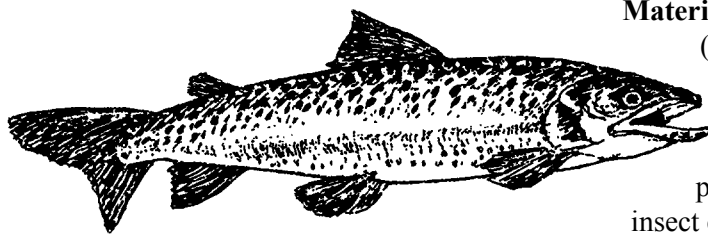


Background: Trout feed on a number of different aquatic insects and their larvae. They are particularly found of snapping up mayflies, caddisflies, stoneflies crane flies and mosquitos, in both their larval/nymph phases and adult phases. Within a stream trout will linger in deep pools, along the bank or beneath other protective cover such as logs in the stream to hide from danger. To feed they must often move out into the stream channel to capture the various aquatic insects upon which they feed. While feeding away from cover, they become vulnerable to various avian predators such as herons, mergansers, kingfishers, bald eagles and osprey. Anglers have long known that trout feed on aquatic insects. To mimic aquatic insects and larva in the stream, anglers tie “flies” from a variety of natural and synthetic materials onto hooks. Fly-tying has truly become an art. Sometimes its even difficult for people to recognize that they are not real insects! These artificial flies are intended to fake-out trout, which often are not able to distinguish the real insects from the simulated ones.

Most trout species thrive only in cold, clean and well-oxygenated mountain streams. Mayflies, stoneflies and caddisflies, the aquatic insects trout primarily feed upon, are especially intolerant to changes in stream conditions brought about by pollutants, and can also only survive in streams with good quality water. Species of aquatic insects slightly more tolerant of pollution include dragonflies and damselflies. In waters of poor water quality only very pollution tolerant species such as crane fly midge larvae, leeches and rat-tailed maggots can survive (they do also survive in clean water however).

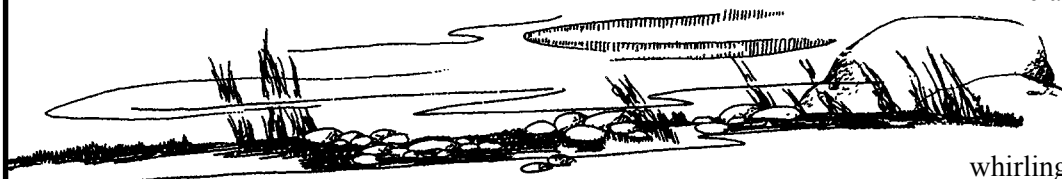
A variety of environmental stressors (pollutants) can negatively impact populations of aquatic insects and trout. For example when trees are removed along the banks of a river, there can be excess soil erosion. The associated increased sedimentation in the stream can smother rocky areas of the stream where aquatic insect larvae live and can fill deep pools needed by trout for cover. The removal of the tree canopy alongside a river can also increase water temperatures in the stream. The loss of leaves, which when they fall into the water provide a source of food for some aquatic insect larvae, also impacts stream quality. Other stressors include sewage and fertilizers, which when entering streams, can induce the growth of algae and bacteria that consume oxygen needed by aquatic insects and trout. Acids leaching from mine tailings can also make streams uninhabitable to aquatic insects and trout. Ironically, the presence non-native trout species (rainbow, brook and brown trout) in western streams poses a threat to native trout species such as cutthroat trout through competition. Parasites such as whirling disease also are a serious problem for trout.

Method: Students engage in a simulation/relay wherein they become trout feeding in a stream.



Materials: Copies of Relay Cards (included). Flagging tape (optional). Chalk or rope to mark playing boundaries (optional).

Procedure: 1) Copy, cut apart and laminate (if possible) aquatic insect adult and larvae cards, artificial insect cards, trout predator cards and pollution cards. For a class of 30 students make about 45 insect cards, 9 artificial insect cards, 9 predator cards and 3 pollution cards and 1 whirling disease card (optional).



Procedure continued:

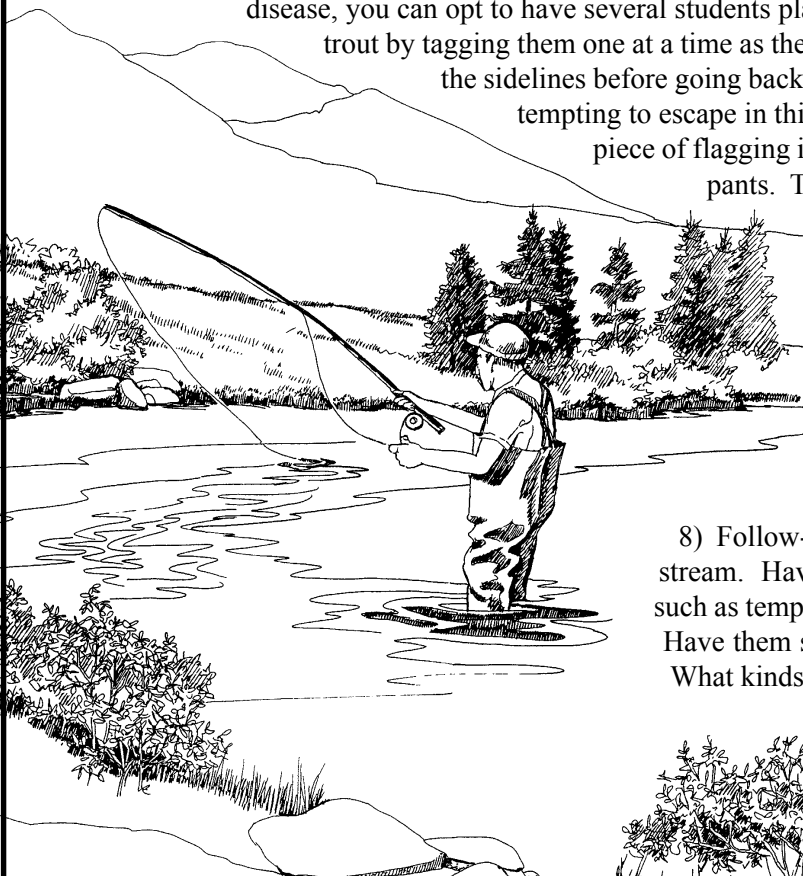
2) Take students to a large playing area. Lay cards out face down throughout the middle of the playing area beforehand. Have students form 4 teams along one side of the playing area. Tell them they are trout living in a stream. The edge of the playing area is one bank where there is cover they can hide in and be safe. The opposite side is the other streambank. In the middle of the playing area is the stream channel with the aquatic insects they feed upon.

3) Tell students that during this simulation/relay, they will be swimming out into the stream channel to feed upon aquatic insects. When the relay starts, one team member at a time will enter the stream channel, pick up **one card**, and then continue across the stream to the other bank. Since they are hungry trout they will need to swim and eat as fast as possible.

4) When the last member of a team reaches the opposite side of the stream, the first team member can start feeding again and swim back to the original streambank. Have them hold onto their first card.

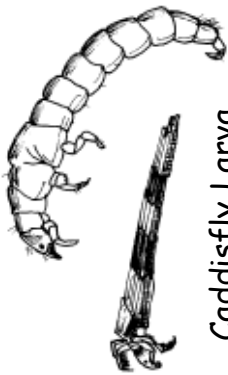
5) After all teams have reached the original side review what each student fed upon. Some trout may have picked up a card with a fake aquatic insect on the end of an anglers fishing line. Assuming it is not a catch and release stream, any of these fish with one or more such cards are headed for the frying pan. Some trout may have picked up an avian predator card on either of the feeding rounds. These fish too are dead. Those that picked up a pollution card did not actually feed because the pollution had eliminated their aquatic insect prey base. They also did not survive. The trout that picked up a whirling disease card die as well. Those that picked up aquatic insects or larvae managed to survive. The team with the greatest number of surviving trout is the winner of the relay.

6) Option: Instead of having cards in the stream represent fake aquatic insects, predators, pollution or whirling disease, you can opt to have several students play these roles. They would catch or impact trout by tagging them one at a time as the trout feed, and bringing them over to one of the sidelines before going back out into the stream. Since trout will be attempting to escape in this scenario, you may want to have trout place a piece of flagging into a pocket or into the waistband of their pants. They would be tagged if their flag was pulled free, and would not participate in a second round if taken out in the first round.



7) After completing the relay discuss the activity with the students to assess their learning. Discuss what people could do to increase aquatic insect and trout survival in streams.

8) Follow-up: Have students investigate a nearby stream. Have them test various water quality parameters such as temperature, pH, and dissolved oxygen levels. Have them search for aquatic insects that may live there? What kinds to they find? Do they see any trout in the stream? Is there sufficient cover for trout? Are they native or non-native trout species? Do they see any birds or other animals that feed upon trout? Are there signs of pollution impacts to the stream?



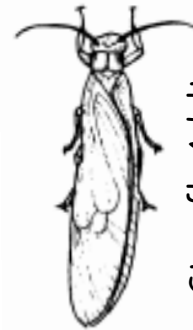
Caddisfly Larva



Caddisfly Adult



Dragonfly Nymph



Stonefly Adult



Crane fly (midge) Larva



Mayfly Adult



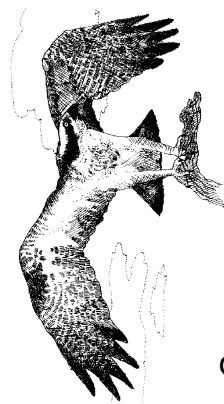
Mayfly Nymph



Stonefly Nymph



Great Blue Heron



Osprey



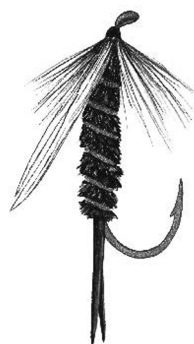
Kingfisher



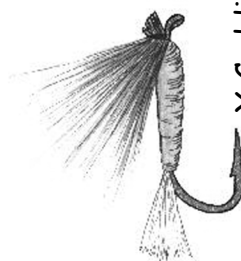
Whirling Disease



Pollution



The Prince Nymph



X Caddis



Gold-ribbed Hares Ear